

Accepted Manuscript

Title: Single crystal growth and variation of thermodynamic and magnetic properties of $\text{Pr}_{1-x}\text{La}_x\text{AlO}_3$ ($x = 0, 0.8$)

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PII: S0025-5408(17)32803-9
DOI: <https://doi.org/doi:10.1016/j.materresbull.2017.11.057>
Reference: MRB 9715

To appear in: *MRB*

Received date: 19-7-2017
Revised date: 18-11-2017
Accepted date: 29-11-2017

Please cite this article as: Chapin Korosec, Makoto Tachibana, Hanna Dabkowska, Bruce D. Gaulin, Single crystal growth and variation of thermodynamic and magnetic properties of $\text{Pr}_{1-x}\text{La}_x\text{AlO}_3$ ($x = 0, 0.8$), *Materials Research Bulletin* (2017), <https://doi.org/10.1016/j.materresbull.2017.11.057>

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Single crystal growth and variation of thermodynamic and magnetic properties of $\text{Pr}_{1-x}\text{La}_x\text{AlO}_3$ ($x = 0, 0.8$)

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Abstract

Two approaches to using optical floating zone (OFZ) technique for single crystal growth of the perovskite $\text{Pr}_{1-x}\text{La}_x\text{AlO}_3$ are discussed, along with the influence on the physical properties of the resulting single crystals due to oxidizing and reducing post anneals. In method one (M1) we used pre-reduced Pr_2O_3 powder starting material, while in the other method, M2, we employed an argon 5% hydrogen reducing environment during the floating zone single crystal growth. Magnetic susceptibility of the low temperature monoclinic phase of $\text{Pr}_{0.2}\text{La}_{0.8}\text{AlO}_3$ is shown to be sensitive to the precise annealing protocol followed. For the post-growth reduced single crystal the magnetic susceptibility is flat across the **R-3c** to **C2/m** structural transition, whereas the oxidized and as-grown samples display a sharp upturn and downturn, respectively. We attribute the low temperature susceptibility differences to relative proportions of Pr^{3+} and Pr^{4+} .

Keywords: Optical Floating Zone Furnace; perovskite; single crystal X-ray diffraction; magnetic tunability; magnetic susceptibility.

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